What Is Claimed Is:

1. A method of monitoring analyte flowing in fluid streams comprising the steps of:

providing a giant magnetoresistive sensor having at least one sensing element which produces electrical output signals that vary dependent on changes in the magnetic field proximate the sensing element;

providing a stream including the analyte, the stream having a magnetic property dependent on the concentration and distribution of analyte therein;

flowing the stream past the giant magnetoresistive sensor in sufficiently close proximity to cause the magnetic properties of the stream to produce electrical output signals from the giant magnetoresistive sensor; and

monitoring the electrical signals produced by the giant magnetoresistive sensor as an indicator of at least one of an analyte concentration, an analyte distribution, and an analyte magnetic property in the stream flowing past the giant magnetoresistive sensor.

2. The method of claim 1 in which the step of providing a stream including the analyte comprises magnetically labeling the analyte for direct detection thereof.

3. The method of claim 2 wherein the step of providing a stream including the analyte comprises injecting the analyte into the stream.

4. The method as set forth in claim 1 wherein the step of providing a stream including the analyte comprises providing a background stream of magnetic particles flowing past the giant magnetoresistive sensor and adding unlabeled analyte to the stream whereby the GMR output represents an indirect measure of the presence of the analyte.

5. A detecting system for monitoring the concentration of analyte present in a flowing fluid stream, the detecting system comprising in combination:

a giant magnetoresistive sensor having at least one sensing element for detecting localized changes in the magnetic field proximate the sensing element;

microfluidic channels associated with the giant magnetoresistive sensor for providing microfluidic channels closely proximate the sensor element, the proximity being such that magnetic particles flowing in the channels will cause an output from the giant magnetoresistive sensor indicative of at least one of the concentration, distribution, and magnetic properties of magnetic particles;

a source of analyte in a fluid stream altered such that the fluid stream has a magnetic property related to the concentration or distribution of analyte in the stream, the source being connected to the microfluidic channels for flowing a stream including the analyte past the giant magnetoresistive sensor; and

an electrical monitor responsive to the giant magnetoresistive sensor for measuring and recording changes in the output signal as an indication of the magnetic properties and therefore analyte concentration or distribution in the stream flowing past the giant magnetoresistive sensor.

6. The detecting system of claim 5 further comprising a magnetic field generator for controllably creating a magnetic field proximate to the at least one sensing element.

7. The detecting system of claim 5 wherein the giant magnetoresistive sensor comprises an array of sensing elements arranged in series.

8. The detecting system of claim 5 wherein the giant magnetoresistive sensor comprises an array of sensing elements arranged in parallel.

9. A method to move a magnetizable object in a microfluidic channel comprising the step of generating a local magnetic field gradient in conjunction with a uniform magnetic field in the presence of the magnetizable object.

10. The method of claim 9 wherein the microfluidic channel splits into a first microfluidic channel and a second microfluidic channel, the magnetizable object has a magnetization direction, the method further comprising the steps of:

generating a first magnetic field to create a first force having a first magnitude in a first direction in the first microfluidic channel;

whereby the magnetizable object moves into the first microfluidic channel in response to the first magnetic field being generated.

11. The method of claim 10 further comprising the step of:

generating a second magnetic field to create a second force in an anti-parallel direction to the first direction in the second microfluidic channel; and

whereby the magnetizable object moves into the first microfluidic channel in response to the first magnetic field and the second magnetic field being generated.

12. The method of claim 11 wherein the step of generating a first magnetic field and a second magnetic field comprises the steps of:

flowing a first current in a first metal strap that is parallel to the first microfluidic channel; and

flowing a second current in a second metal strap that is parallel to the second microfluidic channel, the second current flowing in an opposite direction to the first current flowing in the first metal strap.

13. The method of claim 12 wherein the first metal strap is connected to the second metal strap by a metal strap routed under the microfluidic channel and the steps of flowing the first current and flowing the second current comprises the steps of flowing current into one of the first metal strap and the second metal strap and out of the other of the one of the first metal strap and the second metal strap.

14. The method of claim 10 wherein the microfluidic channel has a sorting region and wherein the first magnitude is sufficient to push the magnetizable object into the first microfluidic channel.

15. The method of claim 10 wherein the magnetizable object comprises a plurality of magnetizable objects, each magnetizable object having a magnetization level needed to move the magnetizable object, each magnetization level different from magnetization levels of the other of the plurality of magnetizable objects and wherein the step of generating the first magnetic field comprises the step of generating the first magnetic field such that the first magnitude is approximately equal to the magnetization level of one of the plurality of magnetizable objects such that the one of the plurality of magnetizable objects moves into the first microfluidic channel and the other of the plurality of magnetizable objects do not move.

16. The method of claim 9 wherein at least one set of three current straps is located under the microfluidic channel and the magnetizable object has a magnetization direction, the method further comprising the steps of:

generating a first oscillating current in a first current strap of the at least one set of three current straps at a first phase angle to form a first oscillating field having a maximum field gradient;

generating a second oscillating current in a second current strap of the at least one set of three current straps at a second phase angle to form a second oscillating field having a maximum field gradient;

generating a third oscillating current in a third current strap of the at least one set of three current straps at a third phase angle to form a third oscillating field having a maximum field gradient; and

whereby the magnetizable object moves in response to a field gradient of each of the first oscillating field, the second oscillating field, and the third oscillating field reaching the maximum field gradient.

17. The method of claim 16 wherein the second phase angle is sixty degrees out of phase from the first phase angle and the third phase angle is sixty degrees out of phase from the first phase angle.

18. The method of claim 16 wherein each of the three current straps are interwoven.

19. The method of claim 18 wherein each current strap is separated from an adjacent current strap by a predetermined distance and the first oscillating current, the second oscillating current, and the third oscillating current is oscillating at a selected frequency and whereby the magnetizable object is pushed along the micro-channel according to the equation

6 *(predetermined distance)*(selected frequency)

20. The method of claim 9 wherein a pair of magnetoresistive detectors are spaced apart at a predetermined distance and across the microfluidic channel, each of the pair of magnetoresistive detectors having at least one sensing element which produces electrical output signals that vary dependent on changes in the magnetic field proximate the sensing element, the method further comprising the steps of:

flowing a magnetized object over the pair of magnetoresistive detectors in sufficiently close proximity to cause the electrical output of the first of the pair of magnetizable detectors to vary as the magnetized object passes over the first of the pair of magnetizable detectors and the electrical output of the second of the pair of magnetizable detectors to vary as the magnetized object passes over the second of the pair of magnetizable detectors;

detecting when the electrical output of the first of the pair of magnetizable detectors varies;

detecting when the electrical output of the second of the pair of magnetizable detectors varies;

measuring a time between the electrical output of the first of the pair of magnetizable detectors varying and the electrical output of the second of the pair of magnetizable detectors varying; and

calculating a velocity of the magnetized object based on the time and predetermined distance.

21. The method of claim 20 wherein the step of calculating the velocity comprises the step of dividing the predetermined distance by the time.

22. The method of claim 20 wherein each magnetoresistive detector comprises a reference resistor connected to a resistor having a resistance that changes in proportion to a magnetic field incident upon the resistor, the resistor placed across the micro-channel and wherein detecting when an electrical output varies comprises the steps of:

flowing a current through the resistor and the reference resistor;

monitoring a voltage across the resistor; and

detecting a change in the voltage across the resistor.

23. The method of claim 9 further comprising the steps of:

generating a first electric field for a first period of time to create a first force having a first magnitude in a first direction in the microfluidic channel;

generating a second electric field for a second period of time to create a second force having a magnitude equal to the first magnitude in a second direction opposite the first direction in the microfluidic channel; and

alternating the first period of time and the second period of time such that the magnetizable object alternately moves in the first direction and in the second direction.

24. The method of claim 23 wherein the step of generating a first electric field and a second electric field comprises the steps of:

flowing a first current in a first metal strap that is parallel to the microfluidic channel; and

flowing a second current in a second metal strap that is parallel to the microfluidic channel, the second current flowing in an opposite direction to the first current flowing in the first metal strap.

25. The method of claim 24 wherein a fluid is present in the microfluidic channel and whereby the step of alternating the first period of time and the second period of time mixes the magnetizable object and the fluid.

26. A microfluidic flow sorter comprising:

a microfluidic channel having a sorting region;

a first microfluidic channel connected to the sorting region;

a second microfluidic channel connected to the sorting region and parallel to the first microfluidic channel;

a first metal strap that is parallel to and on a side of the first microfluidic channel; and

a second metal strap that is parallel to and on a side of the second microfluidic channel.

27. The magnetic microfludic sorter of claim 26 further comprising a metal strap routed under the microfluidic channel and connected to the first metal strap and the second metal strap.

28. A magnetic microfluidic pump comprising:

a microfluidic channel; and

at least one set of three interwoven current straps located under the microfluidic channel.

29. The magnetic microfluidic pump of claim 28 wherein each current strap is separated from an adjacent current strap by a predetermined distance